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SIZE-SELECTIVE PREDATION BY *GEOPHILUS INSCULPTUS* ON *BLANIULUS GUTTULATUS*

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INTRODUCTION

Little is known about the feeding habitats of geophilomorphs. The literature up to about 1980 was reviewed by Lewis (1981, chapter 10). In most cases, plant and decaying material seems to be taken only in cases of prolonged absence of any animal food. However, Gunn & Cherrett (1993), using an underground rhizotron observation chamber with 34 windows, allowing inspection of soil animals down to a depth of 70cm, observed geophilomorphs eating 'inanimate basal resources' such as detritus. The main dietary items of typical inland geophilomorphs appear to be small earthworms, enchytraeid worms and small/soft insect larvae, but there are no substantive data-sets to back up this claim.

There are a few reports of geophilomorphs feeding in groups, and consequently being able to attack quite large or 'difficult' prey items, including barnacles (Blower 1957), *Orchestia* (Lewis 1961), and earthworms up to 8 cm long (Poser 1988). However, individual foraging is probably the norm for most inland species, and here the size of a potential food item may be a major factor in whether it can be successfully attacked and consumed.

In nature, size and taxon are often confounded, making it hard to be certain of the effects of size *per se*. So we conducted an experiment in which different sized individuals of a single prey type - the snake millipede *Blaniulus guttulatus* (Fabricius) - were presented to *Geophilus insculptus* Attems.

SOURCE HABITATS

Our supply of *B. guttulatus* derived entirely from a single, dense population inhabiting a vegetable (potato) plot in a suburban garden in Ponteland, Northumberland (grid ref. NZ151703). Although the area of this plot was only about 7.5 m^2, it housed a *B. guttulatus* population of hundreds, probably thousands, with most being found in association with rotting potatoes. We brought a sample of 300 or so individuals to the laboratory and maintained them in culture as a source population for the experiment.

G. insculptus occurs in the same plot, but at a much lower density (numbers found to date in single figures). Consequently, we used other populations (various sites in Co. Durham) in order to obtain sufficient numbers of *G. insculptus* for our experiment. All *G. insculptus* individuals used were adult. No attempt was made to distinguish males

from females; the sex-ratio of the experimental predators no doubt reflected that prevailing in the source populations at the time of collection.

METHODS

The type of experimental chamber used was a sealed petri-dish containing moistened filter paper covered by a thin layer of soil/peat substrate. Twenty of these were set up (in two trials of 10, separated by about a month). Into each were placed 5 'large' *B. guttulatus*, 5 'small' *B. guttulatus* (modal sizes approximately 7.8 mm and 2.3 mm respectively, with variation of about ± 1mm around each mode) and a single *G. insculptus*. The petri-dishes were maintained in the laboratory for 7 days, after which time the *B. guttulatus* remaining uneaten were counted. (The *G. insculptus* individuals used in the second trial were different to those used in the first, thus avoiding the problem of pseudoreplication.)

RESULTS

The results are shown in Table 1. Clearly, *G. insculptus* does not (can not?) consume the larger *B. guttulatus* individuals. In contrast, one or more smaller individuals were consumed in 14 out of the 20 replicates. This contrast is sufficiently clear that it hardly needs statistical analysis. However, it is perhaps worth noting that the probability of getting this result under a null hypothesis of 'both prey types equally acceptable' is 0.5 to the 13^{th} power, or approximately 0.0001.

In the majority of cases where small individuals were consumed, some parts were left - typically the anterior and/or posterior ends. This is important because complete disappearance of *B. guttulatus* individuals would be an ambiguous result, given that our 'sealed' petri-dishes were not completely airtight, and small individuals might escape more readily than large ones through tiny gaps between base and lid.

DISCUSSION

Why is *G. insculptus* apparently unable to consume the larger (7-8 mm) *B. guttulatus* individuals? Three factors suggest themselves: diameter, hardness and speed, all of which increase with age/length. The maximum diameter of a large *B. guttulatus* is about 0.6 mm (Blower 1985), which is less than the tip-to-tip span of the forcipules of *G. insculptus* when fully opened (approx 1 mm). So it should be physically possible for the larger individuals to be attacked. Escape speed also seems unlikely to be a deterrent, given the manoeuvrability of *G. insculptus* and the limited size of the experimental chamber. So cuticular hardness may be the main factor involved, though further work would be needed to test this hypothesis. Also, there may be other factors that increase with length, for example quantity of defensive secretions, which could be examined in future studies.

TABLE 1

NUMBERS OF LARGE AND SMALL *BLANIULUS GUTTULATUS* CONSUMED BY *GEOPHILUS INSCULPTUS* OVER A 7-DAY PERIOD

		Large specimens		Small specimens	
Trial	Replicate	Eaten	Remaining	Eaten	Remaining
1	1	0	5	1	4
1	2	0	5	1	4
1	3	0	5	2	3
1	4	0	5	1	4
1	5	0	5	3	2
1	6	0	5	1	4
1	7	0	5	0	5
1	8	0	5	2	3
1	9	0	5	0	5
1	10	0	5	1	4
2	11	0	5	1	4
2	12	0	5	2	3
2	13	0	5	1	4
2	14	0	5	0	5
2	15	0	5	0	5
2	16	0	5	1	4
2	17	0	5	2	3
2	18	0	5	1	4
2	19	0	5	0	5
2	20	0	5	0	5

On a broader note, the range of food items consumed by centipedes merits further investigation, not least because of the curious paradox that centipede morphology (including that of the forcipules) has remained virtually constant through vast periods of evolutionary time, over which the available 'prey community' has radically altered. The best evidence for this comes not from geophilomorphs, whose fossil record is poor, but from scolopendromorphs, where the beautifully preserved *Mazoscolopendra* (Carboniferous, ca 300 MY ago: see Mundel 1979) is morphologically very similar to its present-day descendants. Perhaps the resolution of this paradox is that while specialist predators must coevolve with their prey, generalist predators need not. But our current information on centipede feeding is too anecdotal to help much in establishing just how 'generalist' centipede species are; there is a clear need for more quantitative studies.

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